Health Consultation

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HERCULANEUM LEAD SMELTER FACILITY
(a/k/a HERCULANEUM LEAD SMELTER SITE)

HERCULANEUM, JEFFERSON COUNTY, MISSOURI

EPA FACILITY ID: MOD006266373

JULY 13, 2001

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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HERCULANEUM, JEFFERSON COUNTY, MISSOURI

EPA FACILITY ID: MOD006266373

Prepared by:

Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Background and Statement of Issues

The Region VII U.S. Environmental Protection Agency (EPA) requested the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate air, soil, water, and biological data collected in residential and other off-site areas near the Herculaneum Lead Smelter facility in Herculaneum, Jefferson County, Missouri. Information reviewed was collected by the Herculaneum Lead Smelter facility contractors, the Missouri Department of Natural Resources (MDNR), the Missouri Department of Health (MDOH), and the U.S. Fish and Wildlife Service (UFWS).

The city of Herculaneum has an estimated population of 2,255 people, according to the 1990 census (2000 census information is not available). Several homes are within 200 feet of the smelter facility, and at least four homes are located within 200 feet of the slag pile. Figures 1 and 2 display the location of the smelter in relationship to the community. Approximately 67 people live within one-quarter mile of the facility, and 369 people live within 0.25-0.50 miles from the facility. Refer to the attached figures for additional demographic information. Four schools are located in the city: one high school, a middle school and two elementary schools. Herculaneum High School is located 0.5 miles north of the facility; Herculaneum Elementary and Senn-Thomas Middle School are located approximately 1 mile north. From 1990 census data, this school district had approximately 77.5% of individuals with a high school education or less. Approximately 5.9% have a college degree. About 11.1% of the housing in this school district was built before 1930 [1]. The average income in 1990 was $30, 739 [1].

The Herculaneum Lead Smelter is the largest smelter of its kind in the United States. It began operations in 1892 as part of the St. Joseph Lead Company. It is currently owned by the Doe Run Company and operates 24-hours per day, 350 days per year. It is located about 25 miles south of St. Louis, on the Mississippi River. The site is approximately 52 acres in size with two main areas: the smelter plant and the slag storage pile. The smelter plant, occupying 28 acres, is bordered on the east by the Mississippi River and on the west by residential areas. The smelter site consists of office buildings, sinter, smelter, wastewater treatment plant, a sulfuric acid plant, other refining operation buildings, and a slag storage area. The smelter is fenced with gates and signs. The slag storage pile covers 24 acres and is located southwest of the plant in the flood plain of Joachim Creek; it is 40 to 50 feet high in some areas. There is no liner beneath the slag pile. Joachim Creek surrounds the slag storage pile on all sides and empties into the Mississippi River. Some of the areas between the slag pile and Joachim Creek are saturated with water and is very marshy. There are no protective barriers to prevent erosion of slag material into nearby rivers during floods or storms. The Mississippi River and Joachim Creek flood a few times per year from snow melt and seasonal storms [2].

Smelter Operations [2]:

The lead ore concentrate received by the facility is comprised of about 80% lead sulfide. The ore is crushed, heated, and mixed with fluxes and recycled materials from on-site processes to reduce the sulfide content to approximately 50%. Next, the pellet-size concentrate is layered onto a sinter machine grate, where the bottom layer is ignited via gas burners. Combustion precedes through to the top layer. By-products of combustion are largely sulfur dioxide and dust. The sulfur dioxide is routed through baghouses and eventually converted to commercial grade sulfuric acid at the on-site acid plant. The resulting lead sinter is crushed and fed into the blast furnace. It is mixed with coke as it descends into the furnace where it is blasted with hot air and chemically reducing gases produced by the coke. This reduces the sinter into molten lead, which is collected and transferred to the drossing department. Approximately 80% of the molten slag that is produced is granulated and returned as feed stock for the sinter operation. The remaining 20% is added to the slag storage pile.

As the molten lead cools, metal impurities (e.g., nickel, copper) are removed as they form a layer (dross) on the bullion surface. Copper dross is granulated and sold to copper or custom smelters as feed stock. The lead is pumped to the refinery where additional processes are used to remove zinc, copper, arsenic, and silver. All of the refinery drosses (except for silver) are recycled through the blast furnace [3]. The lead is then cast.

In 1996, according to reports submitted to the Toxic Release Inventory (TRI) by the facility, Doe Run released (in pounds): zinc compounds (6,136,006), lead compounds (1,465,366), copper compounds (23,635), chromium compounds (24,658), cadmium compounds (14,587), nickel compounds (7,452), arsenic compounds (7,265), antimony compounds (699), cobalt compounds (385) and sulfuric acid (260).

Environmental Data Summary

Lead

Quarterly averages of 24-hour samples collected every six days are compared to the National Ambient Air Quality Standard (NAAQS) for lead (1.5 ug/m^3). Table 1 summarizes quarterly monitoring results for lead from 1994-1998. Also displayed are the maximum lead level found in a 24-hour sample during each quarter from 1994-2000. The attached figures display the locations of these stations. Currently there are 7 air sampling locations in the vicinity of the Herculaneum Lead Smelter. Seven samplers are operated by the facility; an 8th is operated by MDNR and is co-located at the Herculaneum High School. All but one sample location have been operating since 1982. In 1992, a sampler was placed just west of the smelter facility along Broad Street.

Table 1. Lead results from quarterly ambient-air testing around the Herculaneum smelting facility [2,4]. Results expressed as ug/m^3							
Date & Qtr	Dunklin/ High-school*	Golf	North	Ursaline	Bluff	Sherman	Broad Street
1994							
1st	0.4 (0.5)	0.3	0.2	0.2	0.8	0.6	**3.5**
2nd	0.7 (0.6)	0.3	0.2	0.1	**2.1**	0.5	**3.7**
3rd	1.3 (**1.8**)	0.1	0.3	0.1	0.9	0.6	**3.9**
4th	1.4 (**2.1**)	0.2	0.3	0.1	1.1	0.9	**3.1**
Max 24-hr for yr	11.99	1.50	2.00	1.20	9.93	3.01	22.63
1995							
1st	0.6 (0.7)	0.5	0.2	0.1	1.5	0.8	**6.5**
2nd	0.7 (1.0)	0.1	0.2	0.1	1.0	0.4	**2.5**
3rd	1.2 (1.4)	0.3	0.3	0.2	1.0	1.2	**4.1**
4th	**1.7 (1.9)**	0.4	0.8	0.1	**1.6**	1.3	**6.3**
Max 24-hr for yr	7.52	2.13	2.30	2.41	8.00	4.82	48.01
1996							
1st	**1.9 (2.3)**	0.3	0.4	0.1	1.4	0.8	**2.3**
2nd	1.2 (**1.6**)	0.1	0.1	0.2	**2.4**	0.8	**5.7**
3rd	0.6 (0.8)	0.1	0.2	0.3	0.7	0.5	**4.0**
4th	1.8 (**1.7**)	0.1	0.5	0.3	1.4	0.9	**1.6**
Max 24-hr for yr	9.65	2.77	2.83	1.33	13.20	3.76	21.03

1997							
1st	0.7 (0.8)	0.1	0.1	0.3	1.4	0.5	4
2nd	1.3 (1.4)	0.3	0.2	0.2	0.5	0.4	**6.8**
3rd	1.1 (1.3)	0.1	0.1	0.2	0.8	0.5	**1.6**
4th	1.3 (1.5)	0.5	0.6	0.1	1.3	0.8	**8.5**
Max 24-hr for yr	8.52	2.93	3.17	1.26	7.60	3.60	51.54
1998							
1st	1.1 (1.3)	0.2	0.2	0.2	1.2	0.4	**11.6**
2nd	1.4 (1.5)	0.2	0.3	0.1	0.6	0.5	**4.1**
3rd	0.8 (0.9)	0.1	0.3	0.1	1.1	0.6	**3.9**
Max 24-hr for yr	9.25	1.15	1.94	1.25	11.22	3.03	51.17
1999							
Max 24-hr for yr	19.11	1.11	1.34	0.58	11.30	3.82	42.90
2000							
Max 24-hr for yr	11.59	2.92	1.28	1.13	8.08	5.60	29.33

* data in parenthesis collected by MDNR; all other data collected by facility
Bold type denotes exceedance of ambient air quality standard of 1.5 ug/m^3 for lead

Table 2 summarizes available information on surface soil levels of lead in residential areas around the facility [2]. Sampling and analysis was conducted by the Doe Run Company and/or their consultant.

Table 2. Lead levels in residential surface soil surrounding the Herculaneum lead smelter, concentrations expressed as ppm*

Distance from Facility stack	Range of Lead Levels	Mean (average) Level	Median Level	Number of samples
0 - 0.25 miles	26 - 18,000	3,014	2,346	90
0.25-0.50 miles	367 - 8,507	1,791	1,400	77
0.50-1.0 miles	13 - 2,310	767	557	11

* ppm = parts per million or milligrams lead per kilogram of soil (mg/kg)

Lead and other Metals

Environmental sampling for lead and other metals has been conducted by the U.S. Fish and Wildlife Service (USFWS) and the EPA [2]. Analysis of slag pile material found cadmium (32 ppm), copper (3,200) ppm, lead (23,000 ppm) nickel (140 ppm) and zinc (96,000 ppm). In 1988, six Joachim Creek flood plain soil samples were collected adjacent to the slag piles. Results show the presence of lead (109-26,900 ppm), cadmium (up to 155 ppm), and zinc (up to 99,900 ppm). Between 1989 and 1995, Mississippi River channel sediment samples collected downstream from the facility showed lead levels up to 7,720 ppm and zinc up to 29,400 ppm. In 1998, surface water samples (n=11) from flood plain ditches and flood water pools in Joachim Creek contained lead (0.010 - 13 ppm) and zinc (up to 310 ppm). Finally, fish tissue samples collected from locations downstream of the smelter contained lead from 0.414 to 7.476 ppm lead.

Since 1980, a groundwater monitoring well network around the slag pile has been tested quarterly (by the facility and/or their consultant) for lead, nickel, and zinc. On an annual basis, the wells are tested for arsenic, barium , cadmium, chromium, lead, mercury, selenium, and silver. Lead has been found up to 60.9 parts per billion (ppb or micrograms lead per liter of water, ug/L), cadmium up to 169 ppb, and zinc up to 484 ppb. The MDNR Preliminary Assessment (PA) indicates that groundwater use within 4 miles of the site is extensive and that most businesses and residences are on city water. The city obtains it water from groundwater. This PA also states "pumping rates at the Herculaneum municipal wells which draw water from the Ozark aquifer, may be high enough to engulf the site within the cones of depression that surround the municipal wells."

Other Contaminants

Since 1993, ambient air monitoring has been conducted for sulfur dioxide and inhalable particulate matter (PM10) at the Herculaneum High School sampling location. Tables 3 and 4 display summaries of these data.

Table 3. Sulfur dioxide result summary for the Herculaneum High School Sampling station Concentrations expressed in parts per million (ppm)			
Year	Annual Average	Maximum 24-hr Average	Maximum 1-hr Average
1993	0.010	0.100	0.488
1994	0.010	0.057	0.580
1995	0.010	0.081	0.452
1996	0.010	0.097	0.612
1997	0.007	0.074	0.464
1998	0.004	0.029	0.259
1999	0.004	0.030	0.192
2000	0.004	0.032	0.131
Note: sample station operated by MDNR			

Table 4. Inhalable particulate matter (PM10) result summary for the Herculaneum High School Sampling station Concentrations expressed in ug/m^3*		
Year	Annual Average	Maximum 24-hr Average
1993	21	74
1994	23	92
1995	22	56
1996	20	44
1997	17	41
1998	23	55
1999	instrument removed	

Note: sample station operated by MDNR
* ug/m^3 = microgram particulate matter per cubic meter of air
EPA NAAQS for annual average: 50 μg/m^3; 24 hour average: 150 ug/m^3

Blood Lead Data Summary

Over the last 20 years, 4 blood lead testing efforts have occurred in the Herculaneum community. ATSDR was provided blood lead data for 3 of the 4 testing efforts. The earliest data from 1975 was not available to ATSDR. In 1984, blood lead testing was conducted by Doe Run. A private laboratory was used to analyze the blood samples collected in the community. Details on collection methods, laboratory quality assurance and methodology, and personal identifiers (name, age, sex, distance from facility, etc.) were not provided. Information reviewed is summarized in Table 5. The data indicated that 114 individuals were tested; however, only 97 lead levels were legible on the summary sheet. Of those 97 individuals, 37 individuals had blood lead levels (BLL) below 10 ug/dL, 41 individuals had BLLs between 10-20 ug/dL; 18 individuals had BLL between 21-30 ug/dL and 1 individual had a BLL above 31 ug/dL. Therefore, 60 out of 97 individuals had BLLs above 10 ug/dL; this is approximately 62% of individuals tested.

Table 5. 1984 Blood Lead Levels in Herculaneum, Missouri provided by Doe Run*

Blood lead level in ug/dL	Number of Individuals (n=97)
0 - 9	37
10 - 20	41
21 - 30	18
Above 30	1

* This data only provides information on only 97 of 114 individuals tested in the study. Distance residents' lived from the facility was not available. Soil levels near the homes of individuals tested is not available.

The Jefferson County Health Department (JCHD) with laboratory assistance from MDOH conducted blood lead surveillance in the Herculaneum community from January 1, 1995 to June 10, 1999 in children less than 72 months of age. In addition, some individuals were tested by private physicians and used unknown laboratories. Physicians notified MDOH of these results, and they are included in this surveillance report. This surveillance focused on individuals living in the 63048 zipcode (the Herculaneum zipcode). Blood samples for lead were collected by the JCHD, and analyzed by the MDOH state laboratory. Private laboratory results from private physicians are also reported. Venous samples were taken in the majority of children; however, capillary samples were drawn from 12 children. Distance resident's live from the Doe Run facility was not provided. A total of 100 children were tested for BLL, 26 of which had serial BLLs during this time period. The age of children tested ranged from 5 months to 21.3 months. Of the 74 who did not have serial BLL, 48 had BLL between 0 - 9 ug/dL, and 26 had BLL between 10 - 20 ug/dL. Thus, 35% of these 74 children had BLL above 10 ug/dL. ~~Of all 100 children~~ tested. 43% had BLLs above10 $\mu g/dL$. Table 6 displays a summary of these results.

Table 6. Blood lead levels between January 1995 to June, 1999, conducted by MDOH in Herculaneum, Missouri*	
Blood lead levels in ug/dL	Number of Individuals (n=100)
0 - 9	57
10 - 20	37
21 - 26	6
* Includes first draw results of 26 individuals tested serially. Distance residents lived from the facility was not available. Soil levels near the homes of individuals tested is not available.	

Of the 26 children with serial BLLs, 9 had initial levels between 0-9 ug/dL. Subsequent tests of these children either decreased or remained constant. Eleven of the children had initial blood lead levels between 10 and 20 ug/dL. In subsequent testing of these children, 4 had blood lead levels that decreased to ≤10 ug/dL; 5 had levels that decreased, but remained above 10 ug/dL; 1 had levels that did not change (2 tests total); and 1 had levels that increased (from 12 to 13 ug/dL). Finally, six of the children had initial blood lead levels ranging from 21-26 ug/dL. Subsequent testing of these children showed a decrease in BLL; however, only one child decreased to 10 ug/dL. Others had final BLLs of 13, 16, 17 (2 children), and 18 ug/dL.

In August 2000, blood lead testing was conducted by the JCHD and the MDOH. Doe Run funded this testing and the JCHD obtained blood level samples with oversight from MDOH. Analysis was conducted by Pacific Toxicology Laboratories. Individuals in this testing included residents of Pevely, Crystal City, and Herculaneum. Among these individuals, 68 identified their residence as Herculaneum. The population tested included women of childbearing age and children less than 72 months of age. The age of individuals in this study ranged from 0.6 years to 38 years. Of the 68 individuals tested from Herculaneum, 2 out of 68 individuals had BLLs above 20 ug/dL ,7 out of 68 individuals had BLLs between 10-20 ug/dL, and 59 out of 68 individuals had BLLs below 10 ug/dL. Of the children tested in Herculaneum, 21 % had BLLs above10 μg/dL. Table 7 summarizes these results.

Table 7. Blood Lead Levels by Age in August, 2000 conducted by JCHD and MDOH, and funded by the Doe Run facility in Herculaneum, Missouri*			
Age (years)	Blood lead levels in ug/dL (Number of Individuals)		
	0 - 9 (59)	10 - 20 (7)	Above 20 (2)
0 - 1	4		
1 - 3	9	3	1
3 - 5	19	3	1
5	1	1	
18+ (women)	26		
* Soil levels near the homes of individuals tested is not available.			

Information regarding the distance of participants from the facility was provided in the August 2000 testing. It appears that proximity to the smelter is associated with higher lead levels among residents tested. However, other sources of lead are not provided in the data. Table 8 summarizes these results.

Table 8. Blood Lead Levels in August, 2000 by Sector Analysis and Distance of residence from Smelter in Herculaneum, Missouri			
Average Blood Levels in ug/dL (Number of Children) [BLL range]			
Sector	0 to 0.5 Miles	0.5 to 1 Mile	1 to 1.5 miles
A	9.2 (8) [5.1-11.7]	6.8 (24) [2.3-12.8]	4.2 (18) [1- 8.6]
B	6.95 (2) [5.2-8.7]		
C	3.5 (1)		3.4 (3) [2.2 - 4.4]
D	22.9 (2) [20.2-25.6]		2.1 (2) [1.3-2.9]
Total tested	13	24	23
A = North to North North West of smelter B = North North West to West of smelter	C = West to West South West of smelter D = West South West to South of smelter		

Current Remediation / Regulatory Activities

In 2000, the Region VII EPA, MDNR, and the Doe Run Resources Corporation entered into an Administrative Order on Consent (AOC). The statement of work in this order includes the following: community soil sampling and cleanup; a community blood lead screening program for children; plan development and implementation to reduce air emissions (including lead and sulfur dioxide); and a slag pile/surface water/sediment sampling and analysis plan. The AOC requires that an air emission and control strategy be implemented by July 31, 2002 [5,6].

Currently, residential yards are being remediated (soil excavation, removal, and replacement). The company has been remediating yards since 1990. Initially, homes (n=250) within a ½-mile radius from the facility were targeted; this has recently been expanded (in the AOC) to include homes up to 1.5 miles from the facility (n=930) [7]. The facility has purchased some homes and properties in areas immediately adjacent to the facility. These homes are now being rented from the facility–only people without young children may lease the properties [2].

In 1992, the Herculaneum Lead Smelter was designated a nonattainment facility with respect to lead; it did not meet the national primary or secondary air quality standard for lead. The EPA standard for lead in air is 1.5 micrograms (ug) of lead per cubic meter (m^3) of air averaged over a 3-month period. Since 1995, all but one (Broad Street) of the sampling locations have been below the annual air standard. However, some quarterly averages at the other station have exceeded the standard. To reduce ambient lead levels at the Broad Street location, the facility installed Teflon™ bags in the sinter plant baghouse in 2000 [7]. In 2000, plans began for upgrading ventilation systems in the blast furnace, dross plant, and refinery areas. In addition, new equipment will be added to the drossing area to reduce dust generated from material handling [7].

Discussion

Environmental Data

Environmental data and blood lead data indicate that significant exposures to lead have occurred in the past and are continuing in the present. Residents of the area are being exposed to lead by inhaling lead-contaminated particulates in ambient air at levels that exceed the National Ambient Air Quality Standard. The Broad Street monitoring station, which is located adjacent to a residential area, has recorded violations of the ambient air lead standard in every calendar quarter since the monitor was established in 1992. Lead emissions from smelters are of particular health concern because the bioavailability of lead from smelter particulates may be greater than from lead mining wastes.

Residents could also be exposed to lead through the incidental ingestion of lead-contaminated soil and house dust. Young children are at particular risk for exposure to lead-contaminated soil and dusts because they are more likely to put soiled objects or their fingers in their mouths.

In order to be protective of the health of young children, the EPA has recommended a soil screening level for lead of 400 ppm in residential areas. Within a 0.25 mile radius of the smelter, the average lead concentration in soil samples from residential properties was 3,014 ppm.

An additional source of exposure in some families could be the ingestion of lead-contaminated fish caught in local waterways. In older homes, the presence of lead containing paint could present an additional source of lead exposure.

The available environmental data are inadequate to determine if significant exposures to other environmental contaminants are occurring (e.g., sulfur dioxide in air; metals in soil, sediment, and water). It is not known if the sulfur dioxide sampling location (high school 1 mile from the facility) is providing either representative or worst case exposure data for the community. In addition, no data are available to assess whether there is significant contamination of air particulates or residential soils with metals such as arsenic, cadmium, and nickel. Finally, insufficient information is available to determine if community exposures to lead and other contaminants are occurring through ingestion of groundwater.

Blood Lead Data

Childhood lead poisoning is a major preventable environmental health problem. Children are a high risk group because they are generally assumed to be at an increased risk of exposure to chemicals in soil due to their high soil contact and tendency to ingest soil either intentionally or through normal crawling and "mouthing" behavior. Exposure to lead in utero, in infancy, and in early childhood may also slow mental development and lower intelligence later in life [8]. The Center for Disease Control and Prevention(CDC) recommends that blood levels remain below 10 ug/dL to decrease the likelihood of neurological and learning problems in children [10].

Recent data from the National Health and Nutrition Examination Survey in 1999 (NHANES) conducted by the CDC, stated that the mean blood level in U.S. is 1.6 μg/dL. Average BLLs in the United States have fallen dramatically since the 1970's. Whereas in 1976-1980, the average BLL in children was 15 μg/dL, in 1991-1994, the average was 2.7 μg/dL [10]. The national average for BLL > 10 μg/dL in children is 7.6 % [11]. Despite the reduction in severe lead poisoning, in some U.S. counties, more than 20% of young children tested have BLLs >10 µg/dL [11], this is enough to adversely affect learning and development [12]. Lead hazards are especially common in homes built before 1960. Data from NHANES III, Phase 2 showed that low-income children living in older housing had more than a 30-fold greater prevalence of BLLs $\geq$10 □g/dL than do middle- income children in newer housing [13].

In Herculaneum, about 11.1% of the homes were built before 1930 [1]. The population is generally in the low-income to middle-income range. In addition, the Doe Run facility's emissions of lead in air and ultimate deposition in the environment contribute to this lead exposure. Although low SES and living in older homes (with lead-based paint) is associated with a higher likelihood of elevated BLLs, the significant sources of lead in community soil and air need to be addressed.

Based on the available blood lead data provided by the Doe Run facility and MDOH, significant elevations in blood lead have been documented in this community. The available blood lead data does not represent the entire community; it is not comprehensive in nature. These BLLs are reflective of physician selection or self-selection. During the August 2000 testing, proximity to the smelter appears to be associated with higher lead levels. Twenty-one percent of children tested in August 2000 had BLLs above10 µg/dl, this is higher than the national average of 7.6%. Of the individuals tested for BLLs in 1984 and between 1995 -1999, it appears that the lead levels in these individuals may be declining, however, this is based on the limited available information. Therefore, comprehensive lead testing in the community is essential to understand if this trend can be validated. Information is not available for the following: proximity of home to the smelting facility, soil/dust levels of homes, age of homes, and food and drinking water sources. These factors are essential in understanding and later mitigating the lead exposure in this community. This community has been exposed to air lead levels for decades that can lead to substantial morbidity over generations.

ATSDR Child Health Initiative

ATSDR recognizes that in communities faced with contamination of their air, water, soil, or food, infants and children can be more vulnerable to exposures than adults, because children:

- Are more likely to play outdoors and bring food into contaminated areas
- Are shorter than adults, so are more likely to breathe dust, soil, and heavy vapors that are close to the ground
- Are smaller, resulting in higher doses of chemical exposure per pound of body weight
- Have developing body systems that can sustain permanent damage if toxic exposures occur during critical growth stages.

Because children depend on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests in the Herculaneum community. In this community, children live in the residential community near the Doe Run facility and attend the schools. Children can be exposed to lead from the home, soil, air, and from parental occupational exposure. Consequently, ATSDR is interested in preventing further lead exposure in children

Conclusions

The following conclusions are based on the environmental and blood lead data reviewed by ATSDR.

1. Past and present exposures to lead pose a persistent and unacceptable public health hazard.

2. Community members are unable to reduce their exposures to lead in the ambient air.

3. Ongoing efforts to remediate contaminated yards will assist in temporarily reducing exposures. However, unless the source of soil contamination is stopped (e.g., air deposition of lead onto soils from smelting operations), the surface soil exposure pathway will be completed again in the future.

4. Additional data is required to determine if levels of other contaminants (sulfur dioxide, arsenic, cadmium, etc.) are present at levels of health concern in community soils, water, or air.

Recommendations

Environmental

1. Stop the source(s) of lead in ambient air as soon as possible.

2. Conduct additional sampling and analysis for other contaminants associated with smelting and refining (metals) in ambient air, residential surface soils, and ground water.

3. Conduct air monitoring for sulfur dioxide in community locations most likely impacted from facility operations.

4. Continue efforts to remediate residential and public access areas with elevated lead levels.

5 Consider implementation of interim measures such as sodding or mulching (and periodic replacement) in residential areas until air emissions are no longer a source of continued re-contamination.

Community/Public Health

1. Expand and provide comprehensive blood lead screening to all community members; include all ages. Include in data: proximity to facility, age of home, lead paint in homes, other potential sources of lead, length of residence in Herculaneum, water sources, and soil lead levels near the homes. Use GIS to assist in data collection.

2. Consider an exposure investigation for lead isotope testing among 1-2 homes, to identify the primary source of lead exposure among the residents.

3. Pending results of soil or air sampling for other metals, consider biological (urine) testing for metals including arsenic, cadmium, and zinc to determine if exposures are occurring above reference range (background) levels.

4. Initiate and continue health education efforts in the community and for local physicians.

5. Consider a health study to evaluate the health impacts of contaminants on the community.

References

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2. Missouri Department of Natural Resources, Division of Environmental Quality, Hazardous Waste Program. Preliminary Assessment Report: Herculaneum Lead Smelter Site, Jefferson County, Missouri. March 30, 1999

3. Doe Run Company, Smelting Division, letter from Environmental Manager to C. Kemper, MDNR Waste Management Program. June 4, 1999.

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5. U.S. Environmental Protection Agency, Region 7 Fact Sheet. Herculaneum Lead Smelter Site, Herculaneum, Missouri. May 2001.

6. Doe Run Company, Herculaneum Smelting Division. A Report to Our Community 2000.

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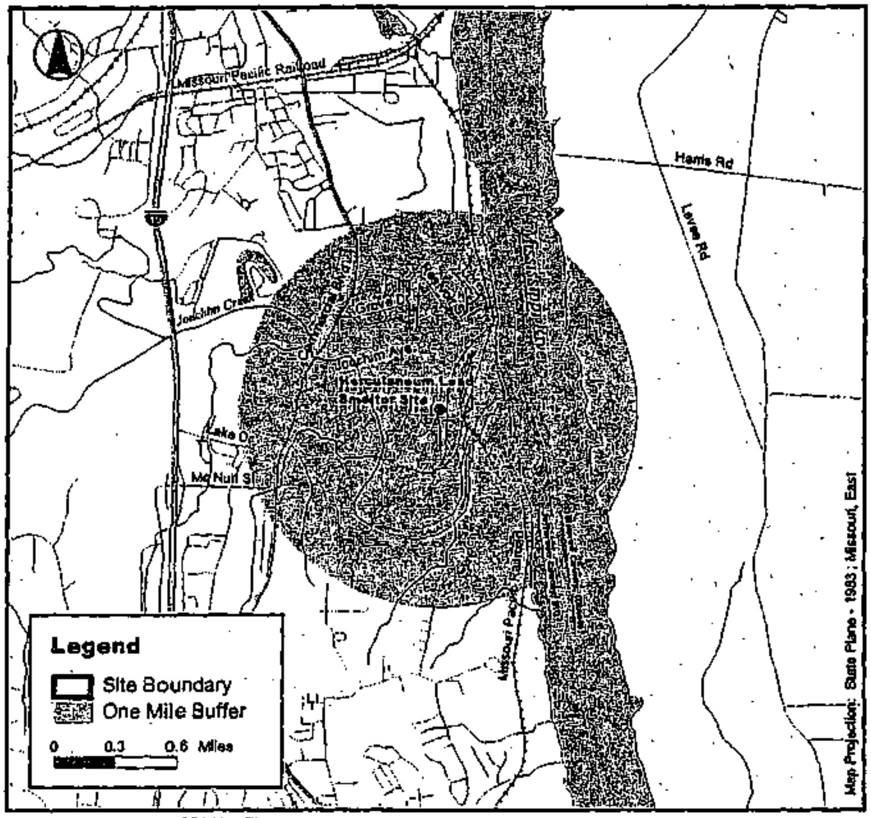
Herculaneum Lead Smelter Site

INTRO MAP

Herculaneum, Missouri

EPA Facility ID MOD006266373



Base Map Source: 1995 TIGER/Line Files

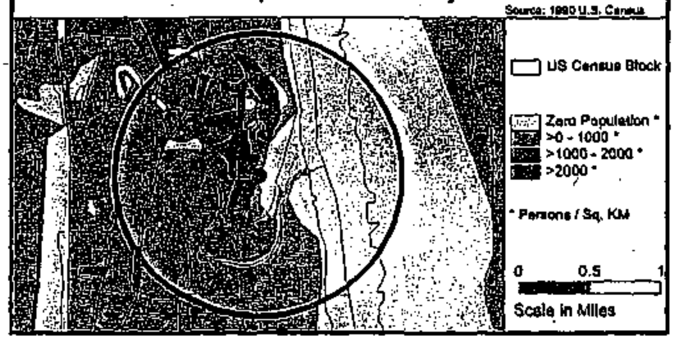
Jefferson County, Missouri

Demographic Statistics Within One Mile of Site*	
Total Population	1741
White	1648
Black	90
American Indian, Eskimo, Aleut	1
Asian or Pacific Islander	1
Other Race	2
Hispanic Origin	6
Children Aged 6 and Younger	163
Adults Aged 65 and Older	232
Females Aged 15 - 44	371
Total Housing Units	684

Demographics Statistics Source: 1990 US Census
*Calculated using an area-proportion spatial analysis technique

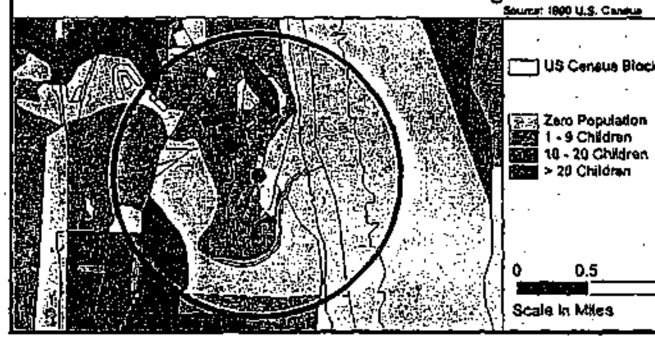
Population Density

Source: 1990 U.S. Census



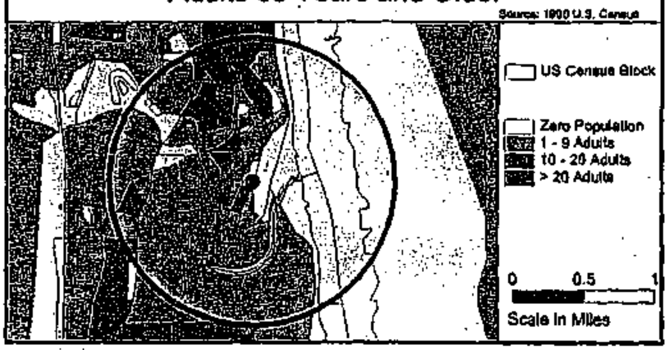
Children 6 Years and Younger

Source: 1990 U.S. Census



Adults 65 Years and Older

Source: 1990 U.S. Census



Females Aged 15 - 44

Source: 1990 U.S. Census

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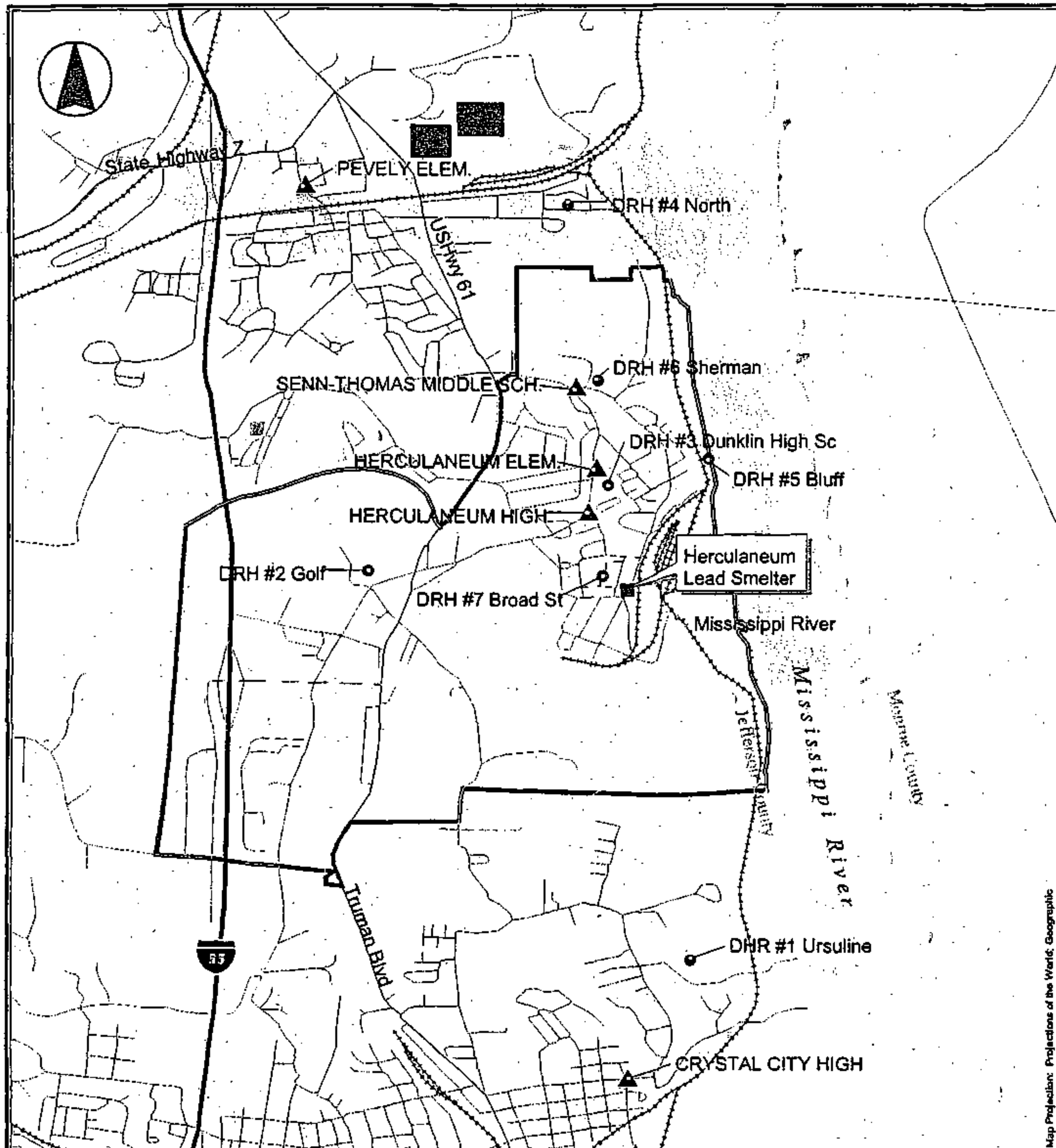
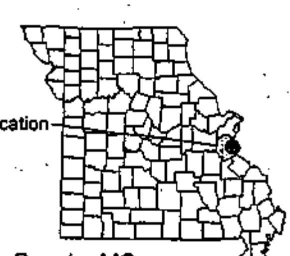


Herculaneum Lead Smelter

Herculaneum, MO

CERCLIS No. MOD006266373

VICINITY MAP



Jefferson County, MO

ATSDR SAAGIS

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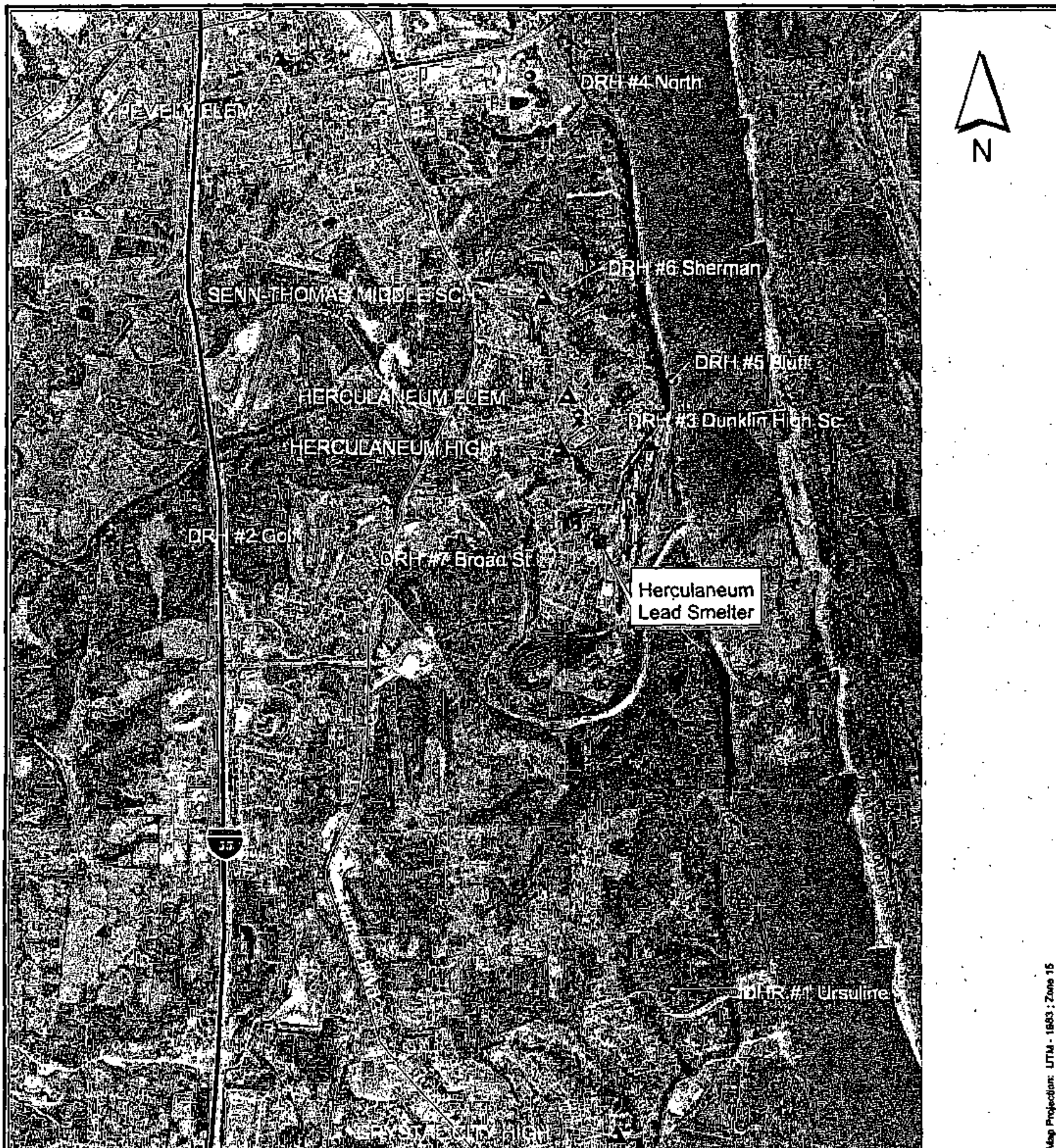
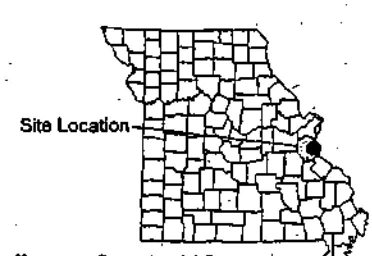


Herculaneum Lead Smelter

Herculaneum, MO

CERCLIS No. MOD006266373

VICINITY MAP



Jefferson County, MO

ATSDR SA GIS

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